US011873028B2

(12) **United States Patent**
An

(10) **Patent No.: US 11,873,028 B2**
(45) **Date of Patent: Jan. 16, 2024**

(54) **FRONT VEHICLE BODY STRUCTURE**

(71) Applicants: **Hyundai Motor Company**, Seoul (KR); **Kia Corporation**, Seoul (KR)

(72) Inventor: **Byeongdo An**, Anyang-si (KR)

(73) Assignees: **Hyundai Motor Company**, Seoul (KR); **Kia Corporation**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/846,850**

(22) Filed: **Jun. 22, 2022**

(65) **Prior Publication Data**

US 2023/0025443 A1 Jan. 26, 2023

(30) **Foreign Application Priority Data**

Jul. 20, 2021 (KR) 10-2021-0094583

(51) **Int. Cl.**

B62D 25/08	(2006.01)
B62D 25/04	(2006.01)
B62D 25/02	(2006.01)
B62D 29/00	(2006.01)
B62D 25/14	(2006.01)
B62D 25/16	(2006.01)

(52) **U.S. Cl.**

CPC ***B62D 25/08*** (2013.01); ***B62D 25/025*** (2013.01); ***B62D 25/04*** (2013.01); ***B62D 29/008*** (2013.01); *B62D 25/14* (2013.01); *B62D 25/16* (2013.01)

(58) **Field of Classification Search**

CPC B62D 25/04; B62D 25/08; B62D 25/081; B62D 25/082; B62D 25/085; B62D 25/088; B62D 29/008

USPC 296/203.01, 2, 193.06, 9, 204, 198

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,296,824 B2 * 11/2007 Yasui B62D 25/04 296/203.02
9,988,095 B2 * 6/2018 Maier B62D 21/15

FOREIGN PATENT DOCUMENTS

EP 3887230 B1 * 10/2022 ..... B62D 25/04
KR 101689575 B1 12/2016

* cited by examiner

Primary Examiner — Dennis H Pedder
(74) *Attorney, Agent, or Firm* — Slater Matsil, LLP

(57) **ABSTRACT**

An embodiment front vehicle body structure includes a fender apron upper member, a front side member coupled to a front portion of the fender apron upper member, and a front pillar unit coupled to a rear portion of the front side member and a rear portion of the fender apron upper member, the front pillar unit including an aluminum material.

20 Claims, 9 Drawing Sheets

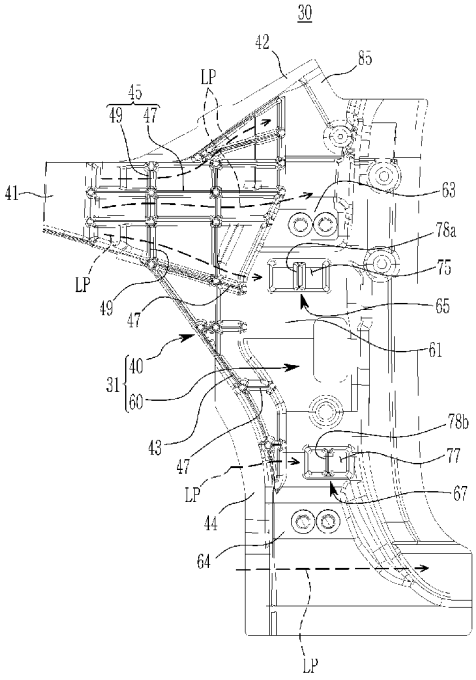


FIG. 1

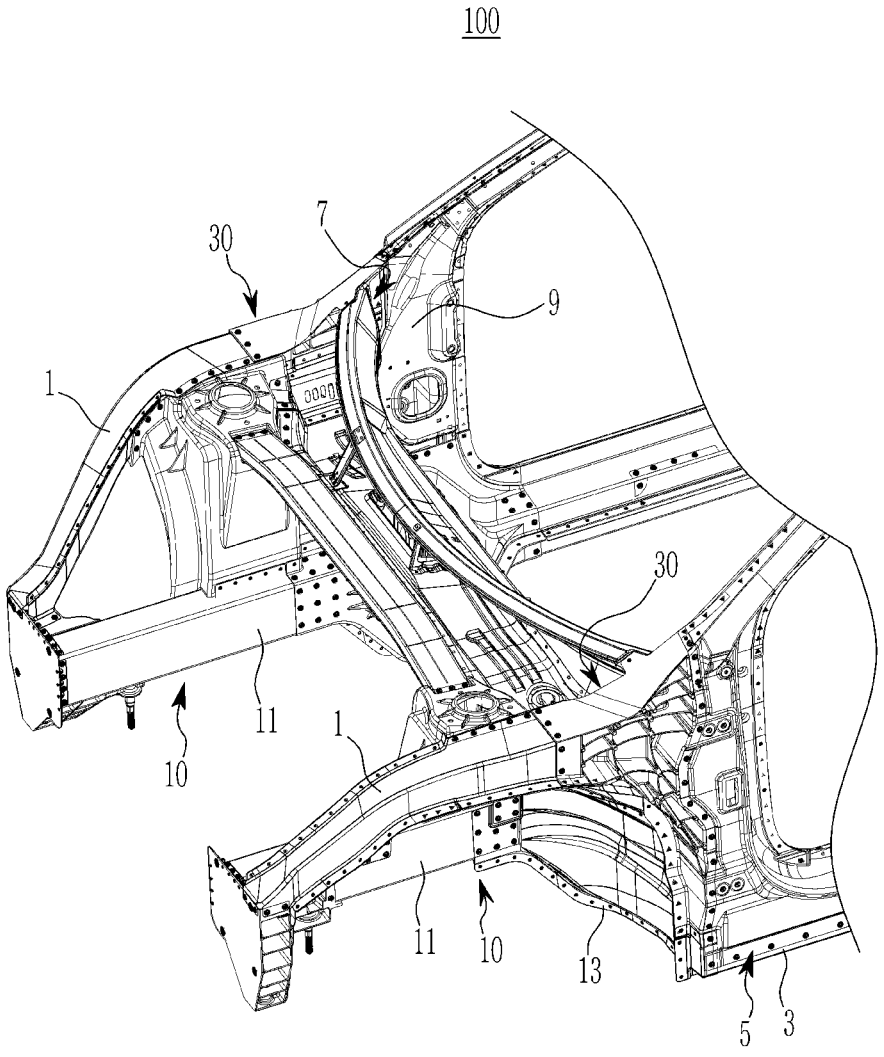


FIG. 2

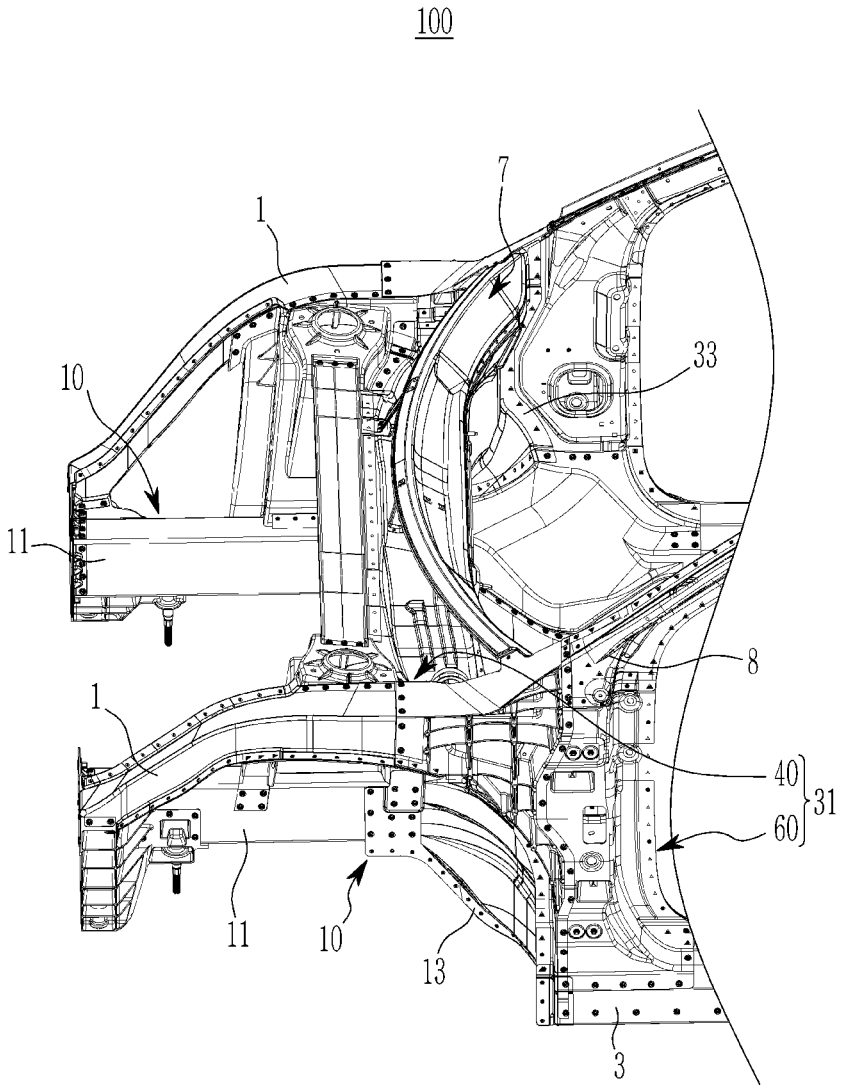


FIG. 3

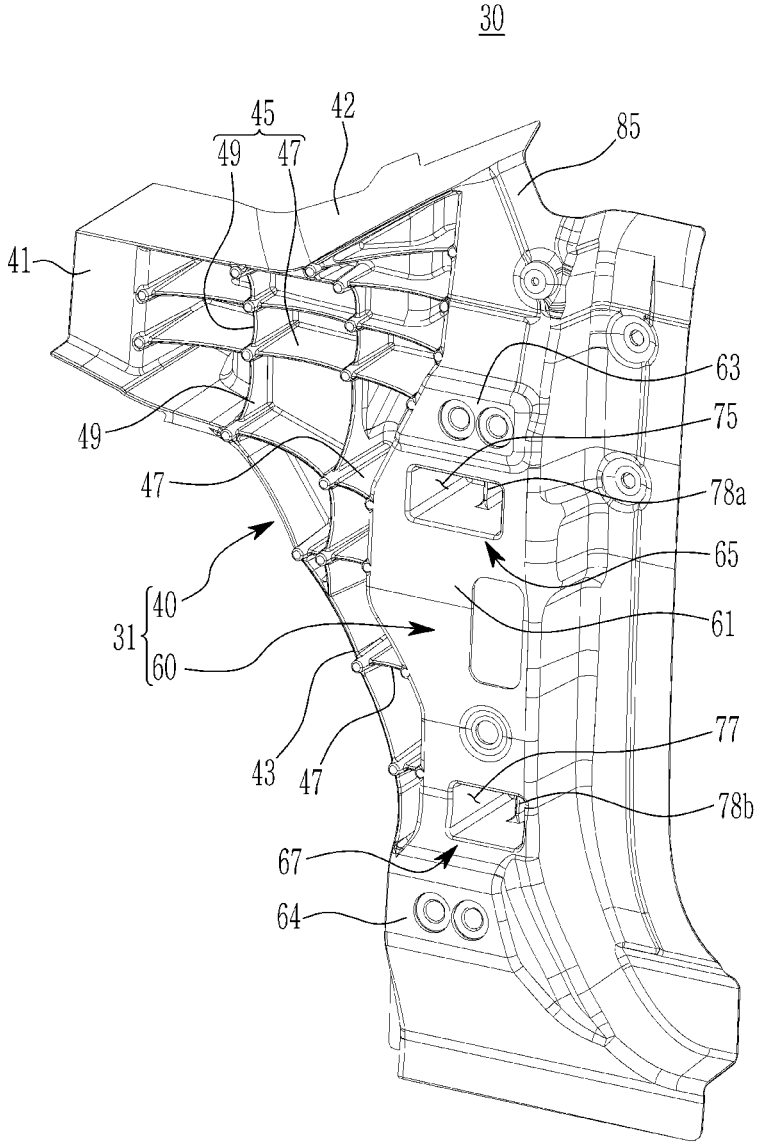


FIG. 4

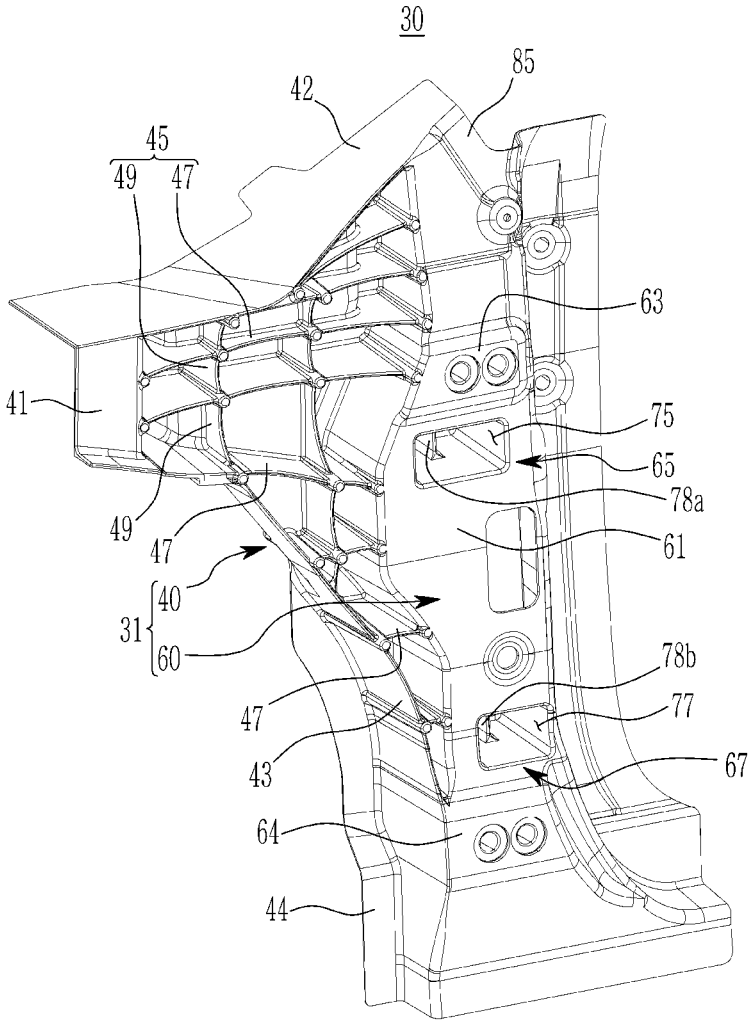

30
85
42
45
49
47
63
41
75
65
78a
49
47
61
40
31
60
78b
47
77
43
67
64
44

FIG. 5

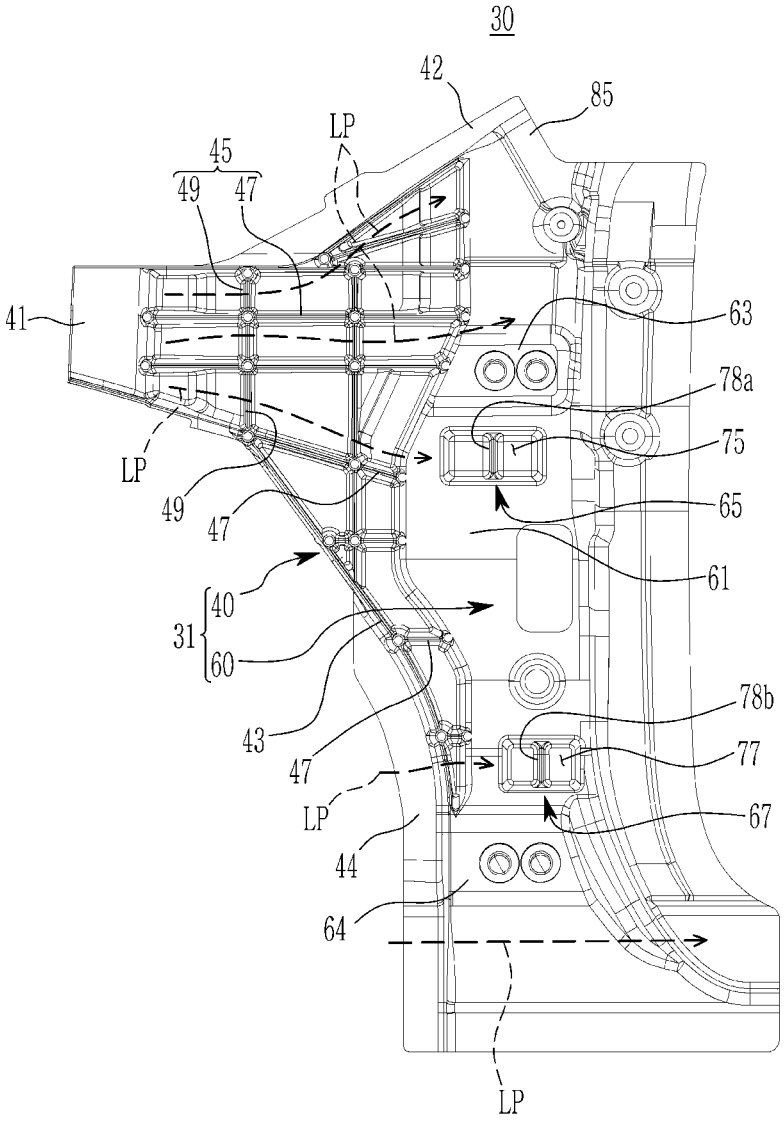

30
42
85
LP
45
49
47
41
63
78a
75
LP
49
47
65
61
40
31
60
78b
43
47
77
LP
67
44
64
LP

FIG. 6

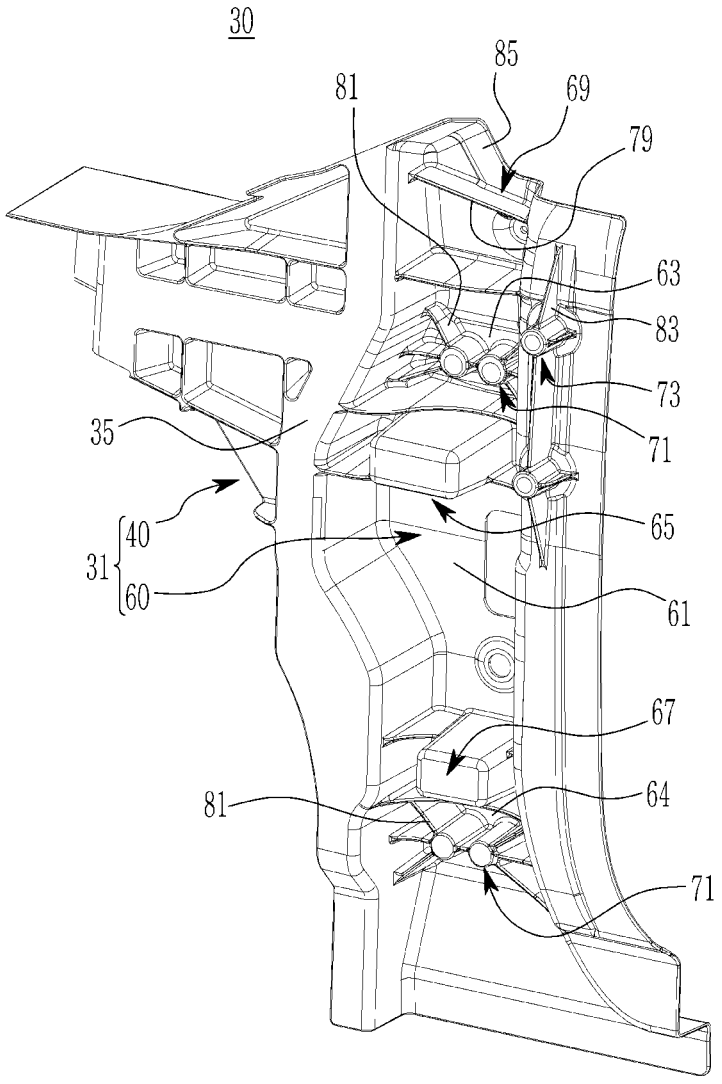


FIG. 7

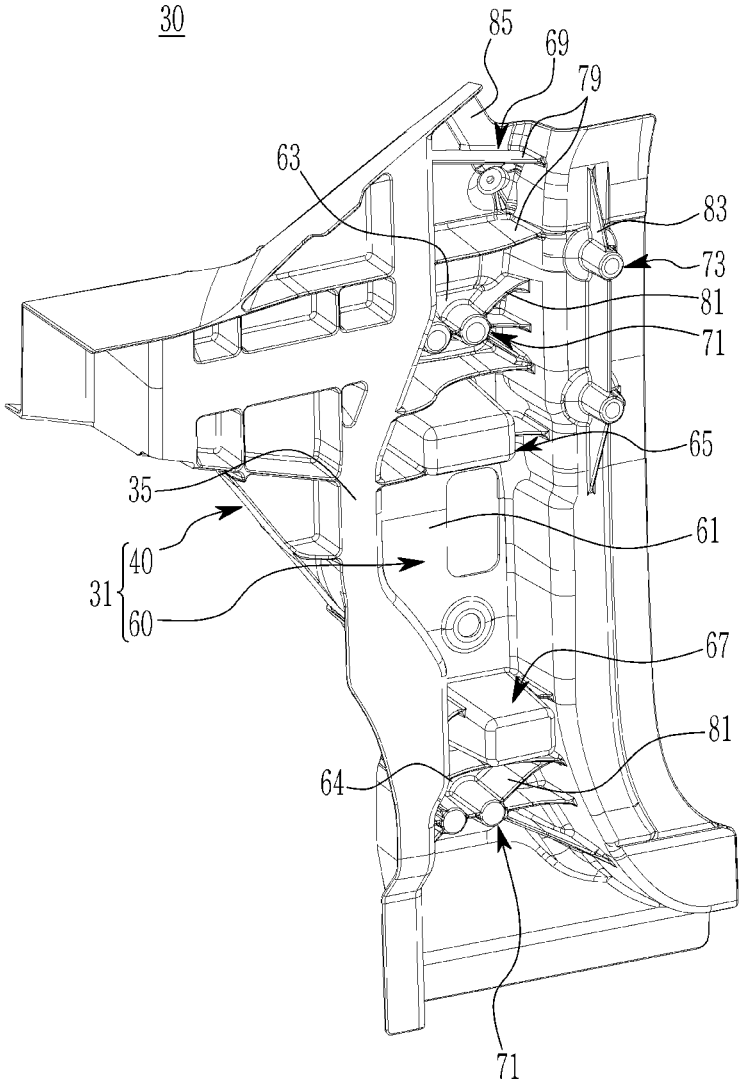


FIG. 8

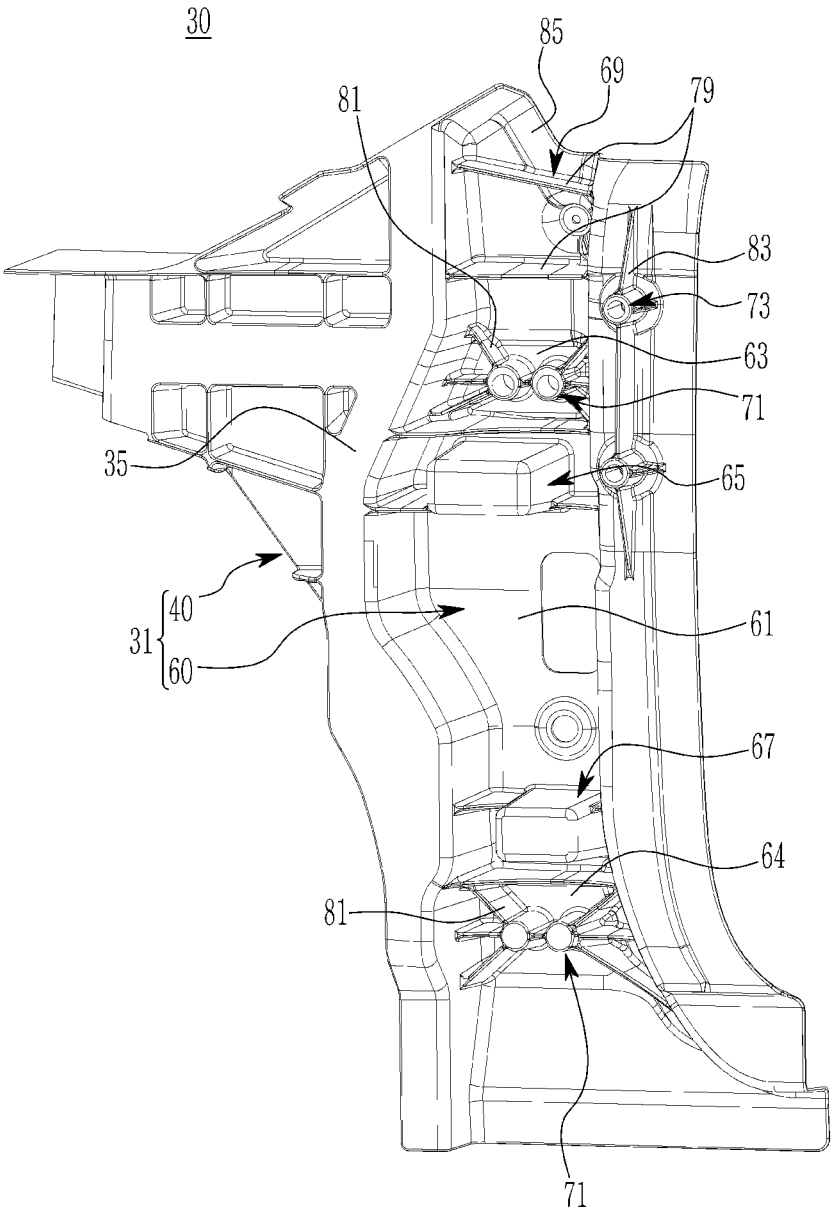
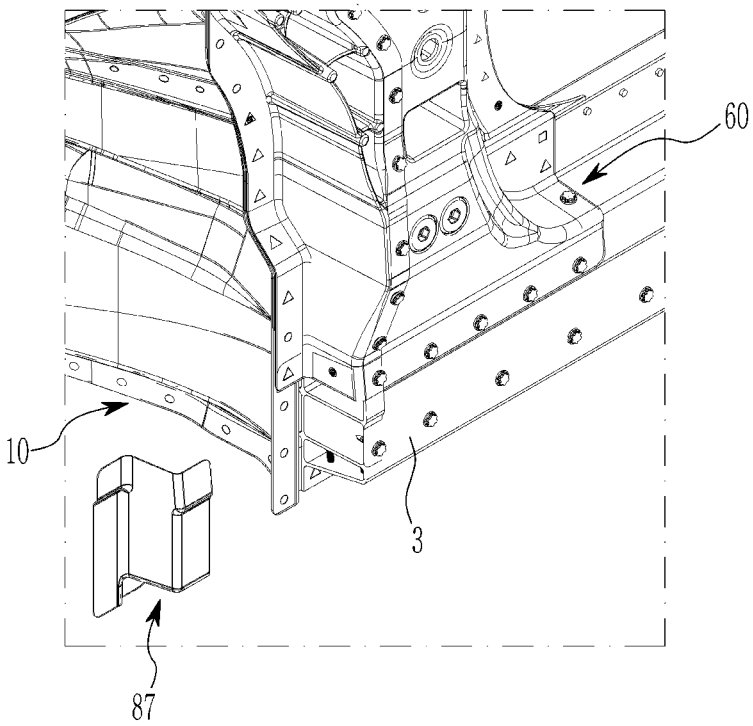


FIG. 9



FRONT VEHICLE BODY STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application No. 10-2021-0094583, filed on Jul. 20, 2021, which application is hereby incorporated herein by reference.

TECHNICAL FIELD

An exemplary embodiment of the present invention relates to a front vehicle body structure.

BACKGROUND

As a way to improve the fuel efficiency of a vehicle, research on reducing the weight of the vehicle body continues.

In other words, the vehicle industry is concentrating on the development of a vehicle body structure that may simultaneously achieve improved strength and reduced weight while satisfying stricter laws related with vehicle collision.

In general, the front vehicle body is extended along the length direction of the vehicle and is provided with front side members disposed on the left and right sides along the width direction of the vehicle.

The front part of the fender apron upper member is coupled to the front part of the front side member. A dash panel and a front pillar assembly connected to a side sill are coupled to the rear portion of the front side member and the rear portion of the fender apron upper member.

In such a front pillar assembly, the load path area along the front and rear direction of the vehicle body is not sufficient, so there is a possibility that the front impact load (collision energy) may not be properly distributed.

In addition, in general, since separate connecting parts for reinforcing the connectivity of the front pillar assembly are required, there is a problem in that the number of vehicle body parts, weight and cost are increased however the connection strength may not be increased.

The above information disclosed in this background section is only for enhancement of understanding of the background of the invention, and therefore it may contain information that does not form the prior art that is already known to a person of ordinary skill in the art.

SUMMARY

An exemplary embodiment of the present invention relates to a front vehicle body structure. Particular embodiments relate to an assembled structure of a front pillar of a vehicle body.

Embodiments of the present invention provide a front vehicle body structure that may reduce the number of parts and reduce cost and weight, increase the strength of the front vehicle body, and improve front crash performance.

A front vehicle body structure according to an exemplary embodiment of the present invention may include front side members combined with a front part of each fender apron upper member respectively, and front pillar units coupled to the rear portion of each of the front side member and the rear portion of each of the fender apron upper member, and made of aluminum material.

Each of the front pillar units may include a front rib reinforcement coupled to the rear portion of the front side member and the rear portion of the fender apron upper member, and a rear rib reinforcement integrally formed with the front rib reinforcement, and coupled to a front part of a side sill and a front part of a side panel.

The front rib reinforcement may include a first flange coupled to the rear of the fender apron upper member, a second flange extending from the first flange to the upper portion of the rear rib reinforcement, and a third flange extending from the first flange to the lower portion of the rear rib reinforcing part.

The front rib reinforcement may include an outer rib formed along the rear extension direction of the fender apron upper member and the front side member on the exterior surface along the vehicle width direction of the front rib reinforcement, and integrally connected to the rear rib reinforcement.

The outer rib may include a plurality of first reinforcing ribs extending along the front and rear direction of the vehicle body, and at least one second reinforcing rib connected with a plurality of the first reinforcing ribs up and down.

The rear rib reinforcement may include an inner rib formed along the rear extension direction of the fender apron upper member and the front side member on the inner side along the vehicle width direction of the rear rib reinforcement, and integrally connected to the front rib reinforcement.

The inner rib may include at least one third reinforcing rib extending along the front-rear direction of the vehicle body.

The rear rib reinforcement may include a side panel mount side formed on the exterior surface along the vehicle width direction, and at least one door hinge mount surface formed on the side panel mount side.

The rear rib reinforcement may include at least one combining boss extending inward from the exterior surface along the vehicle width direction.

The at least one combining boss may include a first combining boss disposed along the rear extension direction of the fender apron upper member, and a second combining boss disposed along the rear extension direction of the front side members.

The at least one combining boss may be combined with a dash inner panel disposed on the inner side along the vehicle width direction of the rear rib reinforcement.

A box space may be formed inside the first combining boss, and at least one first vertical rib extending vertically may be disposed in the box space.

At least one door hinge mount surface may be formed on the exterior surface of the rear rib reinforcement, and at least one first engage boss may be formed on the inner side of the rear rib reinforcement along the vehicle width direction and the at least one first engage boss is formed to protrude inward in the vehicle width direction in the corresponding at least one door hinge mount surface.

The at least one first engage boss may be connected to at least one first connecting rib extending from the inner surface of the rear rib reinforcement.

At least one second engage boss may be formed on the inner surface of the rear rib reinforcement along the vehicle width direction.

The at least one second engage boss may be connected with at least one second connecting rib extending from the inner surface of the rear rib reinforcement.

A member mount surface which overlaps the front pillar upper member may be formed on the upper part of the rear rib reinforcement.

The lower part of the rear rib reinforcement may be coupled to the rear part of the front side member and the front part of the side sill through an extension bracket.

Exemplary embodiments of the present invention may reduce the number of parts, the weight and the cost, increase the skeletal strength and connectivity of the front vehicle body, and improve front crash performance.

In addition, the effects obtainable or predicted by the embodiments of the present invention are to be disclosed directly or implicitly in the detailed description of the embodiments of the present invention. That is, various effects predicted according to embodiments of the present invention will be disclosed in the detailed description to be described later.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments herein may be better understood by reference to the following description in connection with the accompanying drawings in which like reference numerals refer to identical or functionally similar elements.

FIG. **1** and FIG. **2** are perspective views showing a front vehicle body structure according to an exemplary embodiment of the present invention.

FIG. **3** and FIG. **4** are perspective views showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention viewed from outside.

FIG. **5** is an external side view showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention.

FIG. **6** and FIG. **7** are perspective views showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention viewed from inside.

FIG. **8** is an internal side view showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention.

FIG. **9** is a drawing showing an extension bracket portion applied to the front vehicle body structure according to an exemplary embodiment of the present invention.

The drawings referenced above are not necessarily drawn to scale, but are to be understood as presenting rather simplified representations of various preferred features illustrating the basic principles of embodiments of the present invention. Certain design features of embodiments of the present invention, including, for example, particular dimensions, direction, position, and shape will be determined in part by the particular intended application and environment of use.

The following reference identifiers may be used in connection with the accompanying drawings to describe exemplary embodiments of the present disclosure.

1: fender apron upper member	3: side sill
5: side panel	7: front dash panel
8: front pillar upper member	9: dash inner panel
10: front side member	11: member body
13: lower side outer panel	30: front pillar unit
31: aluminum die casting member	33: upper and lower coupling line
35: section line	40: front rib reinforcement
41: first flange	42: second flange
43: third flange	44: fourth flange
45: outer rib	47: first reinforcing rib
49: second reinforcing rib	60: rear rib reinforcement
61: side panel mount side	63: first door hinge mount surface
64: second door hinge mount surface	69: inner rib
65: first combining boss	73: second engage boss
67: second combining boss	77: second box space
71: first engage boss	78b: second vertical rib
75: first box space	81: first connecting rib
78a: first vertical rib	85: member mount surface
79: third reinforcing rib	LP: load path
83: second connecting rib	
87: extension bracket	
100: front vehicle body structure	

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The terminology used in this specification is for the purpose of describing specific exemplary embodiments, and is not intended to limit the present invention.

As used in this specification, the singular forms are also intended to include the plural forms, unless the context clearly dictates otherwise.

The terms 'comprising' and/or 'including' as used in this specification indicate the presence of specified features, integers, steps, operations, elements and/or components, but at least one other feature, integer, step, operation, element and/or component may be present. It should also be understood that this does not exclude the presence or addition of steps, operations, components, and/or groups thereof.

As used in this specification, the term 'and/or' includes any one or all combinations of at least one associated listed item.

In this specification, the term 'coupled' or 'connected' means that components are directly connected to each other by welding, SPR (Self Piercing Rivet), FDS (Flow Drill Screw), structural adhesive, etc. or indirectly connected through at least one intermediary component, and physical relationship between two components.

The terms 'vehicle', 'of a vehicle' or other similar terms used in this specification are generally used in passenger automobiles, including passenger vehicles, sport utility vehicles (SUVs), buses, trucks, and various commercial vehicles, and also including hybrid vehicles, electric vehicles, hybrid electric vehicles, hydrogen power vehicles and other alternative fuel vehicles (e.g., fuels derived from resources other than petroleum).

Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings.

FIG. **1** and FIG. **2** are perspective views showing the front vehicle body structure according to an exemplary embodiment of the present invention.

Referring to FIG. **1** and FIG. **2**, a front vehicle body structure **100** according to an exemplary embodiment of the present invention may be applied to a front structure of the vehicle in which various front structures are connected.

Here, the front vehicle body structure **100** is a front structure positioned between the occupant room and the engine room of the vehicle, and functions to protect the occupant room by effectively supporting the collision load input from the vehicle front.

In this specification, 'vehicle body front and rear direction' may be defined as the length direction of the vehicle body, 'vehicle width direction' may be defined as the left and

right direction of the vehicle body, and 'vertical direction' may be defined as the height direction of the vehicle body.

In addition, in this specification, 'inside the vehicle width direction' may be defined as an inner region (e.g., inner surface) between constituent elements that face each other and are spaced apart, and 'outside the vehicle width direction' may be defined as an outer area (e.g., exterior surface) of constituent elements.

Furthermore, in this specification, 'upper end portion', 'upper portion', 'upper end' or 'upper surface' of constituent elements indicates 'end portion', 'end part', or face of the constituent elements that are relatively upper in the drawing, and of the constituent elements 'lower end portion', 'lower portion', 'lower end' or 'lower surface' of constituent elements indicates 'end portion', 'end part', or face of the constituent elements that are relatively lower in the drawing.

Furthermore, in this specification, the end of the constituent elements (e.g., one end or the other end, etc.) indicates the end of the constituent elements in any one direction, and an end portion of constituent elements (e.g., one end portion or another end portion, etc.) represents a certain part of the constituent elements including the end.

The front vehicle body structure **100** according to an exemplary embodiment of the present invention is configured such that it may reduce the number of parts and reduce cost and weight, increase the strength of the front vehicle body, and improve front crash performance.

The front vehicle body structure **100** according to an exemplary embodiment of the present invention may include, basically, both front side members **10** and a front pillar unit **30** coupled to the front side members **10**.

In an exemplary embodiment of the present invention, both sides of the front side member **10** are extended in the front and rear direction of the vehicle body and disposed on the left and right sides respectively along the vehicle width direction.

In one example, each of the two front side members **10** includes a member body **11**, shaped as for example a rectangular box-shape, and a lower side outer panel **13** joined to the rear of the member body **11**.

Each of these two front side members **10** is well known to a person of an ordinary skill in the art, so a further detailed description will be omitted.

In another example, each of the front side members **10** as described above may be manufactured by an aluminum extrusion method.

Here, the front part of the fender apron upper member **1** is coupled to a front part of the front side member **10**.

The front part of the fender apron upper member **1** may be coupled to the front part of the member body **11**.

In an exemplary embodiment of the present invention, the front pillar unit **30** (also commonly referred to as an 'A pillar unit') is disposed between the occupant room and the engine room in the front part of the side vehicle body including a side sill **3** and a side panel **5** on both sides.

The front pillar unit **30** transmits a load input from the front part of the vehicle body (e.g., a front impact load) to the rear of the vehicle body.

The front pillar unit **30** may transmit the front impact load of both front side members **10** and the fender apron upper member **1** to the side sills **3**, the side panels **5** and the front pillar upper members **8**. That is, the front pillar unit **30** is configured to form a plurality of load paths LP (referring to FIG. **5**) that passes to the rear of the vehicle body.

The front pillar unit **30** is coupled to the rear portions of each of the front side members **10** and the rear portions of the fender apron upper member **1** on both sides.

Hereinafter, each rear portion of the both front side member **10** may be defined as a rear portion of the lower side outer panel **13**.

The front part of the front pillar unit **30** may be coupled to the rear part of the front side member **10** and the rear part of the fender apron upper member **1**.

In addition, the rear portion of the front pillar unit **30** may be coupled to the front portion of the side sill **3** and the front portion of the side panel **5**.

Further, each of the front pillar units **30** is coupled to both ends of the front dash panel **7** disposed along the vehicle width direction from the front part of the vehicle body.

Both ends of the front dash panel **7** are coupled to the inner side of the front pillar unit **30** along the vehicle width direction.

In one example, each of the front pillar units **30** may be manufactured by an aluminum die casting method.

Each of the front pillar units **30** is made of an aluminum die casting member **31** as a single structure in which the side member **10**, the fender apron upper member **1**, the side sill **3**, the side panel **5**, and the front dash panel **7** may be mounted.

FIG. **3** and FIG. **4** are perspective views showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention viewed from outside. FIG. **5** is an external side view showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention. FIG. **6** and FIG. **7** are perspective views showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention viewed from inside. FIG. **8** is an internal side view showing a front pillar unit applied to the front vehicle body structure according to an exemplary embodiment of the present invention.

Hereinafter, the front pillar unit **30** applied to the front vehicle body structure **100** according to an exemplary embodiment of the present invention will be described in detail with reference to the drawings.

Referring to FIG. **1** to FIG. **8**, each of the front pillar units **30** according to an exemplary embodiment of the present invention may include a front rib reinforcement **40** as a front and a rear rib reinforcement **60** as a posterior based on the upper and lower coupling line **33** (referring to FIG. **2**) of the front dash panel **7** connected to its inner side.

The front rib reinforcement **40** is coupled to the rear portion of the front side member **10** and the rear portion of the fender apron upper member **1**.

And, the rear rib reinforcement **60** is integrally formed with the front rib reinforcement **40** and is coupled to the front part of the side sill **3** and the front part of the side panel **5**.

The front rib reinforcement **40** absorbs the collision load input from the front part of the vehicle body and transmits it to the rear rib reinforcement **60**.

And, the rear rib reinforcement **60** transmits the front crash load transmitted from the front rib reinforcement **40** to the rear of the vehicle body through the side sill **3** and the side panel **5**.

That is, the front rib reinforcement **40** and the rear rib reinforcement **60** may form multiple load paths LP to transmit the front collision load from the front side member **10** and the fender apron upper member **1** to the side sill **3**, etc.

Furthermore, the front pillar upper member **8** may be coupled to the upper portion of the rear rib reinforcement **60**.

And, on the inner side of the rear rib reinforcement **60** along the vehicle width direction, a dash inner panel **9** connected to the aforementioned front dash panel **7** may be combined. Referring to FIG. **6**, on the inner side of the front pillar unit **30** along the vehicle width direction, a section line **35** partitioning the front rib reinforcement **40** and the rear rib reinforcement **60** along the vehicle body front and rear directions is formed.

In the section line **35**, both ends of the front dash panel **7** are joined to form the upper and lower coupling line **33** shown in FIG. **2**.

In an exemplary embodiment of the present invention, the front rib reinforcement **40** includes a first flange **41**, a second flange **42**, a third flange **43**, and an outer rib **45**.

The first flange **41** is provided on the front part of the front rib reinforcement **40** and is coupled to the rear part of the fender apron upper member **1**.

The second flange **42** extends from the first flange **41** to the upper portion of the rear rib reinforcement **60**.

The second flange **42** may be formed by extending obliquely in the upward direction toward the upper portion of the rear rib reinforcement **60**. In addition, the third flange **43** extends from the first flange **41** to the lower portion of the rear rib reinforcement part **60**.

The third flange **43** extends toward the lower part of the rear rib reinforcement **60** in an arc shape, and is connected to the lower part of the rear rib reinforcement **60**.

Referring to FIG. **4**, a fourth flange **44** is integrally formed on the third flange **43**.

The fourth flange **44** is coupled to the rear portion of the front side members **10**.

The outer rib **45** reinforces the strength of the front pillar unit **30**, absorbs the collision load input from the front part of the vehicle body, and transfers it to the rear rib reinforcement **60**.

The outer rib **45** is designed to form multiple load paths LP from the front rib reinforcement **40** to the rear rib reinforcement **60**.

The outer rib **45** is formed along the rear extension direction of the fender apron upper member **1** and the front side member **10** on the exterior surface along the vehicle width direction of the front rib reinforcement **40**, and is integrally connected to the rear rib reinforcement **60**.

The outer rib **45** is connected to the first flange **41**, the second flange **42**, and the third flange **43**, and is disposed between the second flange **42** and the third flange **43**.

The outer rib **45** comprises a plurality of first reinforcing ribs **47** and at least one second reinforcing rib **49**.

A plurality of first reinforcing ribs **47** is designed to integrally connect the first flange **41**, the second flange **42**, and the third flange **43** and the rear rib reinforcement **60**.

A plurality of first reinforcing ribs **47** extend along the vehicle body front and rear directions from the first flange **41**, the second flange **42**, and the third flange **43**, and are integrally connected to the rear rib reinforcement **60**.

And, the at least one second reinforcing rib **49** extends vertically from at least one of the plurality of first reinforcing ribs **47**.

In one example, the at least one second reinforcing rib **49** may be provided in plurality.

At least one of a plurality of second reinforcing ribs **49** may form a lattice shape by connecting the plurality of first reinforcing ribs **47** up and down.

In an exemplary embodiment of the present invention, the rear rib reinforcement **60** may include a side panel mount side **61**, at least one door hinge mount surface **63** and **64**, at least one combining boss **65** and **67**, an inner rib **69**, at least one first engage boss **71**, and at least one second engage boss **73**.

The side panel mount side **61** is formed on the exterior surface along the vehicle width direction of the rear rib reinforcement **60** to combine the front part of the side panel **5**.

The at least one door hinge mount surface **63** and **64** is adapted to engage the mounting portion (not shown) of the door hinge (not shown).

The at least one door hinge mount surface **63** and **64** is formed protrude outward along the vehicle width direction from the side panel mount side **61**.

In one example, the at least one door hinge mount surface may include a first door hinge mount surface **63** and a second door hinge mount surface **64**.

The first door hinge mount surface **63** is disposed on the upper side of the rear rib reinforcement **60** and connected to the outer rib **45** of the front rib reinforcement **40**.

And, the second door hinge mount surface **64** is disposed on the lower side of the rear rib reinforcement **60**.

The at least one combining boss **65** and **67** is to be combined with the dash inner panel **9** disposed on the inner surface along the vehicle width direction of the rear rib reinforcement **60**.

The at least one combining boss **65** and **67** is formed to extend inward from the exterior surface along the vehicle width direction of the rear rib reinforcement **60**.

In one example, the at least one combining boss may include a first combining boss **65** and a second combining boss **67**.

The first combining boss **65** is disposed along the rear extension direction of the fender apron upper member **1**.

And, the second combining boss **67** is disposed along the rear extension direction of the front side members **10**.

The first combining boss **65** and the second combining boss **67** may form multiple load paths LP connected to the outer rib **45** of the front rib reinforcement **40**.

In one example, the first combining boss **65** and the second combining boss **67** may be provided in a rectangular box shape.

A first box space **75** is formed inside the first combining boss **65**, and a second box space **77** is formed inside the second combining boss **67**.

In the first box space **75**, at least one first vertical rib **78***a* is disposed extending vertically to the first combining boss **65** formed direction, and in the second box space **77**, at least one second vertical rib **78***b* is disposed extending vertically to the second combining boss **67** formed direction.

The inner rib **69** supports the front impact load transmitted through the outer rib **45** and transmits it to the front side member **10**, the side sill **3**, and the fender apron upper member **1**.

That is, the inner rib **69** is configured to form a plurality of load paths LP connected to the outer rib **45**.

The inner rib **69** is formed along the rear extension direction of the fender apron upper member **1** and the front side member **10** on the inner side along the vehicle width direction of the rear rib reinforcement **60**, and is integrally connected to the front rib reinforcement **40**.

This inner rib **69** includes at least one third reinforcing rib **79** extending along the front-rear direction of the vehicle body.

In one example, the at least one third reinforcing rib **79** may be provided in plurality.

A plurality of third reinforcing ribs **79** may be disposed to be spaced apart from each other at predetermined intervals

along the vertical direction from the inner surface along the vehicle width direction of the rear rib reinforcement **60**.

And, one of the plurality of third reinforcing ribs **79** may be integrally connected with the first combining boss **65**, and another one may be integrally connected with the second combining boss **67**.

The at least one first engage boss **71** is adapted to engage the above-mentioned mounting part of the door hinge to at least one door hinge mount surface **63** and **64**.

The at least one first engage boss **71** is formed on the inner side of the rear rib reinforcement **60** along the vehicle width direction.

The at least one first engage boss **71** is formed to protrude inward in the vehicle width direction in the corresponding at least one door hinge mount surface **63** and **64**.

In one example, the at least one first engage boss **71** may be provided in plurality.

One pair of a plurality of first engage bosses **71** is formed to protrude in the vehicle width direction from the first door hinge mount surface **63**, and may be disposed in a position adjacent to the first combining boss **65** along the vehicle body front and rear directions.

In addition, the other pair of the plurality of first engage bosses **71** is formed to protrude in the vehicle width direction on the second door hinge mount surface **64**, and may be disposed along the vehicle body front and rear directions in a position adjacent to the second combining boss **67**.

Such a plurality of first engage bosses **71** is connected to at least one first connecting rib **81** extending from the inner surface of the rear rib reinforcement **60**.

In one example, the at least one first connecting rib **81** may be provided in plurality.

A plurality of first connecting ribs **81** is adapted to distribute a load concentrated on the plurality of first engage bosses **71**.

The at least one second engage boss **73** is adapted to engage a front cowl crossbar (not shown) disposed in the vehicle width direction from the front part of the vehicle body.

The at least one second engage boss **73** is formed on the inner surface of the rear rib reinforcement **60** along the vehicle width direction.

The at least one second engage boss **73** is formed to protrude from the upper part of the rear rib reinforcement **60** to the inside in the vehicle width direction.

In one example, the at least one second engage boss **73** may be provided as a pair on the upper portion of the rear rib reinforcement **60**.

A pair of the second engage bosses **73** are disposed to be spaced apart in the vertical direction on the upper portion of the rear rib reinforcement **60**.

The second engage boss **73** is connected with at least one second connecting rib **83** extending from the inner surface of the rear rib reinforcement **60**.

In one example, the at least one second connecting rib **83** may be provided in plurality.

A plurality of the second connecting ribs **83** is adapted to distribute the load concentrated on a pair of second engage bosses **73**.

On the upper part of the rear rib reinforcement **60**, a member mount surface **85** is formed that may overlap the front pillar upper member **8** mentioned above.

The member mount surface **85** may be combined with the front part of the front pillar upper member **8**.

As shown in FIG. **9**, the lower part of the rear rib reinforcement **60** may be coupled to the rear part of the front side member **10** and the front part of the side sill **3** through an extension bracket **87**.

The extension bracket **87** is connected to the lower part of the rear rib reinforcement **60**, the rear part of the front side member **10**, and the front part of the side sill **3**, and serves to close the open front end of the side sill **3**.

Hereinafter, referring to FIG. **1** to FIG. **9**, the operation of the front vehicle body structure **100** according to an exemplary embodiment of the present invention will be described.

Each front side member **10** is attached to a respective front pillar unit **30** at a respective aluminum die casting member **31**.

The front part of the fender apron upper member **1** is coupled to each front part of the front side member **10** on both sides.

Each of the front pillar units **30** is coupled to each rear part of both front side members **10** and to the rear part of the fender apron upper member **1**, and is coupled to each front part of the side sills **3** and each front part of the side panels **5**.

Here, both ends of the front dash panel **7** are coupled to the section line **35** on the inner side of the front pillar unit **30** along the vehicle width direction.

Each of these front pillar units **30** includes the front rib reinforcement **40** and the rear rib reinforcement **60** integrally connected based on the upper and lower coupling line **33** of the front dash panel **7** coupled to section line **35**.

The front rib reinforcement **40** is coupled to the rear portion of the front side member **10** and the rear portion of the fender apron upper member **1**.

The rear rib reinforcement **60** is coupled to the front part of both side sills **3** and the front part of both side panels **5**.

Here, the front pillar upper member **8** is coupled to the upper part of the rear rib reinforcement **60**.

The lower part of the rear rib reinforcement **60** integrally connected with the lower part of the front rib reinforcement **40** is coupled to the rear part of the front side member **10** and the front part of the side sill **3** through the extension bracket **87**.

And, on the inner side of the rear rib reinforcement **60** along the vehicle width direction, the front dash panel **7** and the connected dash inner panel **9** are combined.

Furthermore, the front rib reinforcement **40** includes the outer rib **45**.

And, the rear rib reinforcement **60** includes the door hinge mount surface **63** and **64**, the combining boss **65** and **67**, the inner rib **69**, and the engage boss **71** and **73**.

In the above, the dash inner panel **9** is combined with the combining bosses **65** and **67**.

In one of the engage bosses **71**, and **73**, the mounting part (not shown) of the door hinge (not shown) is engaged, and in the other, a front cowl crossbar disposed in the vehicle width direction from the front part of the vehicle body (not shown) is engaged.

The front vehicle body structure **100** according to an exemplary embodiment of the present invention may effectively support the front side member **10**, the fender apron upper member **1**, the side sill **3**, and the side panel **5** by the front rib reinforcement **40** and the rear rib reinforcement **60** of the front pillar unit **30**.

The front vehicle body structure **100** according to an exemplary embodiment of the present invention may effectively absorb the front collision load input from the front part of the vehicle body through the outer rib **45**.

In addition, the front vehicle body structure **100** according to an exemplary embodiment of the present invention may effectively transmit the front crash load to the rear rib reinforcement **60** through the multiple load paths LP formed by the outer rib **45**.

And, the front vehicle body structure **100** according to an exemplary embodiment of the present invention may support the front crash load transmitted from the front rib reinforcement **40** through the inner rib **69** of the rear rib reinforcement **60**, the door hinge mount surface **63** and **64**, the combining boss **65** and **67**, and the engage boss **71** and **73**.

In addition, the front vehicle body structure **100** according to an exemplary embodiment of the present invention may effectively transmit the front crash load to the front side member **10**, the side sill **3**, and the fender apron upper member **1** by the rear rib reinforcement **60**.

Therefore, the front vehicle body structure **100** according to an exemplary embodiment of the present invention may improve the front collision performance of the vehicle body by effectively distributing the collision load by the front pillar unit **30** during the front collision of the vehicle.

Further, the front vehicle body structure **100** according to an exemplary embodiment of the present invention comprises the front pillar unit **30** with an aluminum die casting material, it is possible to reduce the weight and cost of the vehicle.

Furthermore, since the front vehicle body structure **100** according to an exemplary embodiment of the present invention does not require separate connection parts for structural reinforcement by the front pillar unit **30**, it is possible to reduce the number of parts, the weight and the cost.

While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. On the contrary, it is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. A front vehicle body structure comprising:
- a fender apron upper member;
- a front side member coupled to a front portion of the fender apron upper member; and
- a front pillar unit coupled to a rear portion of the front side member and a rear portion of the fender apron upper member, the front pillar unit comprising an aluminum material, wherein the front pillar unit comprises:
  - a front rib reinforcement coupled to the rear portion of the front side member and the rear portion of the fender apron upper member; and
  - a rear rib reinforcement integrally formed with the front rib reinforcement and coupled to a front part of a side sill and a front part of a side panel;
- wherein a door hinge mount surface is formed on an exterior surface of the rear rib reinforcement; and
- wherein a first engage boss is formed on an inner side of the rear rib reinforcement along a vehicle width direction, the first engage boss protruding inward in the vehicle width direction in the door hinge mount surface.

2. The front vehicle body structure of claim **1**, wherein the front rib reinforcement comprises:
- a first flange coupled to the rear portion of the fender apron upper member;
- a second flange extending from the first flange to an upper portion of the rear rib reinforcement; and
- a third flange extending from the first flange to a lower portion of the rear rib reinforcement.

3. The front vehicle body structure of claim **1**, wherein the front rib reinforcement comprises an outer rib formed along a rear extension direction of the fender apron upper member and the front side member on an exterior surface along the vehicle width direction of the front rib reinforcement and integrally connected to the rear rib reinforcement.

4. The front vehicle body structure of claim **3**, wherein the outer rib comprises:
- a plurality of first reinforcing ribs extending along a front-rear direction of a vehicle body; and
- at least one second reinforcing rib connected with the plurality of the first reinforcing ribs in a vertical direction.

5. The front vehicle body structure of claim **1**, wherein the rear rib reinforcement comprises an inner rib formed along a rear extension direction of the fender apron upper member and the front side member on an inner side along the vehicle width direction of the rear rib reinforcement and integrally connected to the front rib reinforcement.

6. The front vehicle body structure of claim **5**, wherein the inner rib comprises a third reinforcing rib extending along a front-rear direction of a vehicle body.

7. The front vehicle body structure of claim **1**, wherein the rear rib reinforcement comprises:
- a side panel mount side formed on an exterior surface along the vehicle width direction; and
- a door hinge mount surface formed on the side panel mount side.

8. The front vehicle body structure of claim **1**, wherein the first engage boss is connected to a first connecting rib extending from the inner side of the rear rib reinforcement.

9. The front vehicle body structure of claim **1**, wherein a second engage boss is formed on an inner surface of the rear rib reinforcement along the vehicle width direction.

10. The front vehicle body structure of claim **9**, wherein the second engage boss is connected with a second connecting rib extending from the inner surface of the rear rib reinforcement.

11. A front vehicle body structure comprising:
- a fender apron upper member;
- a front side member coupled to a front portion of the fender apron upper member;
- a front pillar unit coupled to a rear portion of the front side member and a rear portion of the fender apron upper member, the front pillar unit comprising an aluminum material, wherein the front pillar unit comprises:
  - a front rib reinforcement coupled to the rear portion of the front side member and the rear portion of the fender apron upper member; and
  - a rear rib reinforcement integrally formed with the front rib reinforcement and coupled to a front part of a side sill and a front part of a side panel; and
- a member mount surface overlapping a front pillar upper member and disposed on an upper part of the rear rib reinforcement.

12. The front vehicle body structure of claim **1**, wherein a lower part of the rear rib reinforcement is coupled to a rear part of the front side member and the front part of the side sill through an extension bracket.

13. A front vehicle body structure comprising:
- a fender apron upper member;
- a front side member coupled to a front portion of the fender apron upper member;

a front pillar unit coupled to a rear portion of the front side member and a rear portion of the fender apron upper member, the front pillar unit comprising an aluminum material;

a front rib reinforcement coupled to the rear portion of the front side member and the rear portion of the fender apron upper member; and

a rear rib reinforcement integrally formed with the front rib reinforcement and coupled to a front part of a side sill and a front part of a side panel, the rear rib reinforcement comprising, a combining boss extending inward from an exterior surface along a vehicle width direction;

wherein a door hinge mount surface is formed on an exterior surface of the rear rib reinforcement; and

wherein a first engage boss is formed on an inner side of the rear rib reinforcement along the vehicle width direction, the first engage boss protruding inward in the vehicle width direction in the door hinge mount surface.

14. The front vehicle body structure of claim **13**, wherein the combining boss comprises:

a first combining boss disposed along a rear extension direction of the fender apron upper member; and

a second combining boss disposed along the rear extension direction of the front side member.

15. The front vehicle body structure of claim **13**, wherein the combining boss is coupled to a dash inner panel disposed on an inner side of the rear rib reinforcement along the vehicle width direction.

16. The front vehicle body structure of claim **13**, further comprising a box space defined inside the combining boss, wherein a vertical rib that extends vertically is disposed in the box space.

17. The front vehicle body structure of claim **13**, wherein the front rib reinforcement comprises:

a first flange coupled to the rear portion of the fender apron upper member;

a second flange extending from the first flange to an upper portion of the rear rib reinforcement; and

a third flange extending from the first flange to a lower portion of the rear rib reinforcement.

18. The front vehicle body structure of claim **13**, wherein the front rib reinforcement comprises an outer rib formed along a rear extension direction of the fender apron upper member and the front side member on the exterior surface along the vehicle width direction of the front rib reinforcement and integrally connected to the rear rib reinforcement.

19. The front vehicle body structure of claim **11**, wherein the front rib reinforcement comprises:

a first flange coupled to the rear portion of the fender apron upper member;

a second flange extending from the first flange to an upper portion of the rear rib reinforcement; and

a third flange extending from the first flange to a lower portion of the rear rib reinforcement.

20. The front vehicle body structure of claim **11**, wherein the front rib reinforcement comprises an outer rib formed along a rear extension direction of the fender apron upper member and the front side member on an exterior surface along a vehicle width direction of the front rib reinforcement and integrally connected to the rear rib reinforcement.

* * * * *